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INSECTS IN RELATION
TO
NATIONAL DEFENSE

Circular 19

LIVESTOCK INSECTS



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Circular 19 - Livestock Insects

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INTRODUCTION

Horses, dogs, and pigeons used in the armed forces are subject to attack by a number of insects which not only lower the efficiency of animals but also may carry diseases to them. Lice injure horses by sucking their blood, thus

lowering their vitality and in severe cases, causing death. Several kinds of mange mites live in or on the surface of the skin of horses and produce a condition termed scabies or mange. Animals are greatly annoyed by the intense itching caused by this disease and often break open the scabs or nodules in their effort to secure relief. In severe cases animals may succumb. Mange in dogs is also caused by the presence of mange mites. Lice suck the blood of dogs and are a drain on the animals' nervous energy. The vitality of pigeons used as messengers is often lowered and their performance is handicapped by the presence of several different insects. One such pest, the pigeon fly, sucks the blood of these birds and in addition is known to carry pigeon malaria to them. Mites on pigeons are irritating and in some cases cause deformities.

INSECTS ATTACKING HORSES

Lice, mites, dogflies or stableflies, and horse bots are all common pests of horses, while horn flies, screwworms, and chicken and bird mites occasionally are annoying to these animals.

LICE

Introduction.--Lice attacking livestock are of two types--sucking and biting. Both are wingless, have flattened bodies, and legs which are somewhat adapted for clinging to hairs. In general, the sucking lice may be distinguished from the biting lice as follows: The heads of sucking lice are long and pointed, being longer than broad, the mouth parts are formed for sucking and piercing, and the compound eyes are indistinct. In contrast, the biting lice have short, rounded heads, chewing mouth parts, and a pair of simple eyes. The sucking lice are the more injurious of the two as pests of mammals, since they puncture the skin and suck their blood. As a result the animal's vitality

is lowered, it loses weight, and occasionally, if the infestation is very severe, the animal may die. The biting lice generally attack birds, but a number of species also live on mammals, feeding on hair, dermal scales, and exudations from the skin. The irritation is largely caused, however, by the insects crawling on the animals and their continuous gnawing on the skin, rather than sucking blood. This produces restlessness, failure to eat, and loss of weight, and stunts the growth of young animals. In addition, infestations by either kind of lice make animals vulnerable to attack by other insects. Both sucking and biting lice are spread chiefly by animals in direct contact with one another, although infested equipment and premises are further sources of infestation.

Description and life history.--In the United States the sucking horse louse (Haematopinus asini (L.)) (fig. 1) is the most important of three species of lice attacking horses. About one-quarter of an inch long, this louse is similar to the biting species except that it is much larger and has a long, pointed head. The female attaches her eggs firmly to the hairs of the animal where they hatch usually in 12 to 14 days. In about 10 or 11 days after hatching, females begin laying eggs. The remaining two species which frequently annoy horses are biting lice, Trichodectes pilosus Giebel, and T. equi (L.) (fig. 2). These are generally yellowish or reddish brown in color. They attach their eggs in the same general way as the sucking lice. Eggs hatch in about 10 days. Both sucking and biting lice live only a few days when removed from their host. During the summer most of the lice disappear with the shedding of the animal's hair, but a few remain and the infestation builds up again during the next winter.



Fig. 1.--Sucking horse louse.

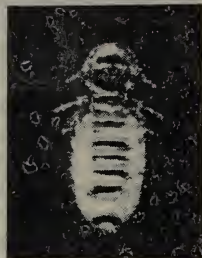


Fig. 2.--Biting horse louse.

Injury.--As a result of severe infestations of lice, the coat of the animal becomes rough, and owing to frequent rubbing, patches of hair are removed and abrasions are made in the skin. In addition, the animal's vitality is lowered.

Control.--In order to eliminate lice as well as eggs, it is necessary to dip horses twice, with an interval of 14 to 16 days. The dips generally recommended are, in order of their importance: arsenical solution, coal tar creosote, and nicotine.

1. Arsenical solution: Proprietary cattle dips used to control the cattle fever tick are suitable for use on horses, mules, and asses against lice. These dips should be mixed and used at the strength recommended on the container. Caution: Do not let animals drink

dip, do not get clothing wet with dip, and wash hands frequently.

2. Coal tar creosote: This material is sold under many trade names and is satisfactory when diluted with soft water. It should not be used in hard or alkaline water as it may not mix well with water and may injure the animals. The dip may be used warm or cold, but if warm, should not exceed 95° F.

3. Nicotine: Nicotine dips may be purchased under various trade names but should be diluted with water in order to contain not less than five hundredths (.05) of 1 percent nicotine. A solution of nicotine, if used much stronger, may injure animals. This dip is used warm but it should not be heated above 110° F., and the temperature of the bath should be kept at 90° to 95° F. Caution: Avoid using any nicotine dip, the strength of which is not given on the container. Follow instructions on the label.

4. Dry treatment: In case dipping vats are not available or if the season of the year does not warrant dipping, dusting powders may be applied. Powders are of value in holding parasites in check but as a rule cannot be relied upon to control sucking lice. Sodium fluoride is effective in controlling biting lice when applied with a dust gun, shaker, or by hand. Care should be taken not to apply this material freely around natural body openings or where the skin is very thin or hairless. Sodium fluoride should not be rubbed into the skin. Derris, cube, or pyrethrum powders are reasonably effective against both biting and sucking lice.

MANGE MITES

Introduction

Mange of animals is a contagious skin disease produced by tiny spider-like parasites known as mites which live on or beneath the surface of the skin. They are commonly known as sarcoptic, psoroptic, and chorioptic mites, all of which live at the expense of their hosts by puncturing the skin and causing lesions or wounds. Because of the infectious nature of mites and their mode of living on or in the skin, mange is considered as a communicable disease. So far as is known these mites carry no organisms which can be transferred to the blood stream of their hosts, as does the tropical rat mite which is capable of transmitting typhus. Although the presence of mites may be recognized by the general symptoms of each type of mange, the only definite way of discovering their presence and species is to scrape thoroughly the outer edges of the infected areas with a dull knife and transfer these scrapings to a dark surface such as black paper. The paper should then be spread in the sun or near heat. The warmth will cause the mites to become active and they can be seen as tiny whitish objects moving about. As a rule mites are transmitted from one animal to another by direct contact, although they may be spread by infested equipment. These mites live only a short time away from their host, three weeks being about the limit of their existence.

Sarcoptic Mites

Of the three kinds of mites mentioned above the most difficult to control are the sarcoptic mites because of their habit of burrowing into the skin. In equines sarcoptic mange is caused by Sarcoptes scabiei Deg. Mites of this genus are minute, yellowish or whitish parasites which form galleries in the skin where mating and egg laying take place.

Each female makes a separate burrow and dies there after egg laying is completed. The entire life cycle takes place in approximately 15 to 24 days.

S. scabiei equi (Gerlach) may infest man, carrying what is known as "cavalryman's itch" among soldiers attending horses.

Symptoms of sarcoptic mange.--Lesions or lumps are formed over the burrows, and scabs or granules may appear as a result of the discharge of serum from the lesions. These lesions are usually found in early stages of the disease on the neck, shoulders, or around the head, but the disease may start on the breast, flanks, sides, or other parts of the trunk. With the advance of the disease, patches on the animal become more or less bare. In severe cases animals lose weight and may die.

Psoroptic Mites

Psoroptic mites, known as Psoroptes communis equi (Gerlach) produce psoroptic mange, or common scab. Mites causing this disease live in colonies on the surface of the skin rather than in galleries in the skin. Visible to the naked eye, oval in form, possessing a tapering head which is longer than broad, and larger than sarcoptic mites, these parasites are best observed when they are placed against a dark background. The complete life cycle is spent on their host where the female deposits 15 to 24 eggs. After 4 to 7 days' incubation, the eggs hatch. The young mites reach sexual maturity, mate, and begin depositing eggs in 10 to 12 days from time of hatching.

Symptoms of psoroptic mange.--Psoroptic mange usually starts on portions of the animal more thickly covered with hair. Mites pierce the skin and apparently introduce a toxin into

the wound. Vesicles are formed, and the serum from these, caused to flow by scratching, becomes mixed with foreign matter including micro-organisms. Yellowish or gray colored scabs appear and the mites move to healthy areas around the scab, thus increasing the extent of injury. Some mites move to new regions of the body until large areas of skin become denuded of hair. Intense itching causes animals to bite and scratch themselves, resulting in breaking or tearing off the scabs. Very advanced cases become emaciated and unless given proper treatment may die.

Chorioptic Mites

Very similar to psoroptic mites, chorioptic mites live in groups on the surface of the skin and make lesions which closely resemble those of psoroptic mange. A characteristic difference, however, in these two kinds of mange is the location of the lesions which, in the chorioptic mange, is confined chiefly to the legs or tail, from which the common name foot or tail mange is derived. In severe cases lesions may spread to the abdomen. This disease is produced in horses by Chorioptes equi (Hering).

Control of sarcoptic, psoroptic, and chorioptic mange:--Animals should be dipped in lime sulfur or nicotine solutions, proprietary brands of which are available. Lime sulfur is known as liquid-lime sulfur, or in powder form is known as dry lime sulfur. Nicotine compounds are sold under various trade names and when diluted with water the dip should contain not less than 0.05 percent nicotine. Two dippings, 10 to 12 days apart, are usually sufficient for psoroptic and chorioptic mites, but about 4 or more dips at intervals of 6 to 7 days are necessary for sarcoptic mites because insecticides do not always penetrate the depth

of all burrows and contact the mites. Prepared dips should be used warm and diluted or mixed according to directions on the container. Complete directions are given in Farmers' Bulletin 1017 of the United States Department of Agriculture.

Note: Animals having unhealed wounds should not be dipped but should be treated with dry lime sulfur. Animals should not be dipped until several hours after feeding and should be immersed completely. The liquid should be kept at 95° to 105° F. and animals kept in solution long enough to become fairly well soaked, not less than two minutes for infested animals. Horses infested with mites should be isolated and stables as well as pens disinfected with a strong coal tar creosote solution. Otherwise stables should be vacated for three weeks so that any mange mites present may die.

STABLEFLY OR DOGFLY

The stablefly, known as a vicious biter in practically all parts of the world, is capable of transmitting a number of diseases to livestock, such as anthrax, surra, and swamp fever. Horses are particularly annoyed by their presence. If fly infestation is severe, the work efficiency of horses is lowered by loss of blood and their vitality may be so reduced as to permit certain diseases to become acute and cause their death. A detailed account of the stablefly will be found in Defense Circular 17.

HORSE BOTS

Larvae of botflies attach themselves to the walls of the stomach and intestine of horses

and mules, thereby lowering their efficiency. In addition, more feed is required to keep an infested animal in condition. Aside from annoying animals by depositing their eggs, botflies, if present in numbers, may cause horses to become uncontrollable. A light infestation of horse bots in the digestive tract is often unnoticed, but heavy infestations may cause sore throats, emaciation, colic, and even stoppage of the digestive tract, sometimes resulting in death. For further discussion on the habits and control of these pests, see Defense Circular 16.

HORN FLIES

Although primarily a pest of cattle, the horn fly (Siphona irritans L.) (fig. 3) occasionally attacks horses. It is about one half the size of a housefly, has a pointed beak, and is a fierce biter. Flies of this species usually occur in clusters on the animal. On warm and cloudy days the adults are most prevalent, annoying animals by their presence and by sucking blood. As a result of this loss of blood, the animal's vitality is lowered.



Fig. 3.--Female horn fly.

Life History

Eggs are laid in fresh manure where they hatch out and become mature larvae in about 4 to 5 days. The larvae then crawl into the lower part of the dropping or into the soil to pupate. In 6 or more days after the pupal case is formed the adult emerges. A minimum of 9 to 12 days completes the life history and the flies may live for about 7 weeks.

Control.

Two practical methods of controlling horn flies are as follows:

1. Destroy maggots by breaking manure so that maggots may become exposed to the sun and air and dry out quickly.
2. Kill adult flies on animals by applying livestock sprays preferably composed of extract of pyrethrum and kerosene oil. Do not spray directly on the animal but generate a fine mist around the animal, particularly around the legs and under the belly.

SCREWORMS

Screwworms are a menace to livestock in southern portions of the United States, Central America, Mexico, West Indies, and throughout South America except the southern portion. Horses and mules are usually attacked in scratches, wire cuts, saddle and harness sores, as well as in the sheath of the penis owing to local irritation. Screwworm flies are attracted to wounds of all kinds, in which they lay their eggs and larvae develop.

Bloody discharges, such as those from men suffering from nasal catarrh, also may attract the flies. Larvae eat out the tissue in the wound and if the infestation is severe and treatment neglected, pockets may be eaten out beneath the skin, and the animal or man may eventually die. A discussion of the habits of the screwworm and its control is given in Defense Circular 18.

HOUSEFLY TRANSMISSION OF A ROUNDWORM
PARASITE TO HORSES

Although of minor importance to horses, the housefly (Musca domestica L.) transmits a roundworm, Habronema muscae, which is a stomach worm of horses. In the adult housefly these worms are usually found in the head, but they may be found in other parts of the fly's body. Horses accidentally swallow these infected flies, or flies cluster around lips of horses, the moisture stimulating the passage of the roundworm larvae which then gain entrance to the mouth.

Since horse manure is one of the chief media in which houseflies breed, the protection of manure from oviposition of these flies is one of the most important steps in their control. Further reference to the housefly and its control will be found in Defense Circular 8, pages 2-14.

CHICKEN AND BIRD MITES
AS PESTS OF HORSES AND PIGEONS

Several kinds of mites annoy birds, chiefly poultry, but frequently pigeons and

livestock are affected by them. If horses are kept in buildings where wild birds make their nests, the animals may be annoyed by the mites. In this case nests should be removed and the surrounding area sprayed with a fly spray. Birds' nests in trees should also be removed if infestation of mites is coming from this source. The two most common mites likely to be encountered on pigeons and livestock are the chicken mite (Dermanyssus gallinae Deg.) and the feather mite (Liponyssus sylviarum Canad. & Fanz.)

CHICKEN MITE

Hiding by day in cracks and crevices, this mite usually attacks its victims at night. Vitality of birds is lowered and sometimes even death is caused. Development from egg to adult requires about one week but the life span is extended during cold weather.

Occasionally people who handle pigeons are annoyed by these mites. Old buildings used as barracks may harbor chicken and bird mites if poultry or birds have been nesting in these places.

Control

Boxes, boards, and trash all harbor mites. Remove such equipment and burn nesting material and litter. Spray roosts with crude petroleum or creosote oil early in the day so that materials may soak in before the pigeons go to roost. Caution: Creosote oil should be kept away from body and clothes as it is somewhat caustic and will burn.

FEATHER MITE

The feather mite attacks a number of wild birds which may spread mites to pigeons by contact with them. It is a severe pest since it remains on the host most of the time. The female lays her eggs among the feathers and the mites complete their development on the host. This pest causes a dirty appearance on the feathers of birds. Heavy infestations lower the vitality of birds, and a scabby condition of the skin results.

Control

Since this mite seldom leaves the host, it is necessary to dip the birds rather than treat the roosts. Each individual should be dipped in a sulfur bath (2 ounces of fine sulfur and 1 ounce of soap to a gallon of water). This should be done on a warm sunny day or in a warm building. If this is not possible, birds may be dusted with fine sulfur, or nicotine sulfate may be sprayed on perches. Burning nest material and litter while the pigeons are being dipped is recommended. Nests of sparrows and other wild birds should be pulled down and burned if they are suspected of harboring mites, and the area where they are located then treated with a fly spray.

INSECTS ATTACKING DOGS

Since several insects and their close allies, the mites and ticks, not only annoy dogs by their presence, but cause loss of blood and spread disease or parasites to animals

and man, it is of interest to keep dogs in a healthy condition. Early diagnosis of such situations will greatly aid in keeping up the efficiency of dogs. Mange mites cause a disease of dogs that may easily be fatal. Present on almost any dog are fleas which cause much irritation and scratching. In addition the cat, dog, and human fleas may act as intermediate hosts for the double-pored tapeworm. If dogs go through areas infested with chiggers, many of these mites may be picked up and cause sores to develop. Ticks not only are a drain on the blood of dogs but may cause paralysis and in some cases disease. Through the medium of certain lice, tapeworms may be carried to dogs.

Further information concerning fleas, chiggers, and ticks may be found as follows:

Fleas-----see Defense Circular 13.
Chiggers---see Defense Circular 14.
Ticks-----see Defense Circular 12.

MANGE MITES

Dogs are subject to three types of mange--the sarcoptic, ear, and demodectic--all of which are caused by mites living in or on the surface of the skin. Sarcoptic mange may occur all over the body, while ear mange is generally confined to the ears. Demodectic or red mange occurs over the body. In the early stages of this disease, the skin often appears red and the hair falls out. A disagreeable mousy odor is frequently evident in sarcoptic and red mange.

If dogs are not removed from premises for about three weeks so that any mange mites present may die, the premises should be treated with a hot, strong coal tar creosote solution. Kennels should be disinfected with this solution particularly if other dogs are present. All bedding and litter should be burned if possible.

Sarcoptic Mites

A mite, Sarcoptes scabiei canis Gerl , is the cause of sarcoptic mange of dogs. Mites of this species are barely visible to the naked eye. Females make galleries in the upper layer of the skin where 20 to 40 eggs are laid. These hatch in 3 to 7 days, the larvae maturing by molting. The entire life cycle from egg to adult requires two to three weeks. Only the females burrow into the skin, the larvae, nymphs, and males living under crusts or scabs on the surface.

Symptoms of sarcoptic mange.--Any age or breed of dog is susceptible to sarcoptic mange. Although the disease may become evident on any part of the body, it usually first appears on the head, bridge of nose, around eyes, or at the base of the ears. If control measures are not applied, the whole body will become involved.

The first symptoms of sarcoptic mange are the red points which in a short time develop into small blisters. Scabs are formed by the exudation or discharge of serum by females. Intense itching follows and the animal, in attempting to ease his irritation, may scratch the scab and secondary bacterial

infection may follow. The skin becomes wrinkled and thickened. The hair mats and falls out. If the disease is not checked, the dog's digestion and other body functions may be impaired. Death may follow in a few months. It is possible for humans to contract the disease through handling mangy animals.

Control of sarcoptic mange.--Dogs should be clipped, bathed, and all crusts and scabs removed before insecticides are applied. After a complete course of treatment the dog should be bathed and the process repeated until the animal is cured. Several control measures are recommended:

1. Derris ointment, similar to that used in ear mange, or a wash consisting of 4 ounces of derris powder (containing 5 percent rotenone), 1 ounce of a nonalkali soap, and 1 gallon of warm water may be used. This mixture should be rubbed in well with a brush and the surplus wash taken up with a towel. The remainder should be left to dry on the animal. Two or three treatments are necessary to cure the animal.

2. An ointment prepared by thoroughly mixing 1 part flowers of sulfur with 8 parts lard is a simple mixture that has given good results.

3. Two parts sublimed sulfur, 1 part oil of tar, 1 part potassium carbonate, and 8 parts lard has been successfully used.

Ear Mites

The ear canal of dogs may be invaded by ear mites, Otodectes cynotis (Hering), (fig. 4)



Fig. 4.--Female ear mite of dogs.

which are responsible for a condition known as ear mange. These are similar to sarcoptic mange mites but are much larger and longer legged. They may be seen with the naked eye as tiny white creatures. The life cycle is similar to that of the sarcoptic mites. They obtain their food by puncturing the skin and sucking the tissue juices of the ear canal near the eardrum.

Symptoms of ear mange.--Irritation by these mites may result in interference with the normal production of ear secretions. Inflammation causes accumulation of exudates and modified wax in the ear. Dogs often hold their heads to one side and in advanced cases run around in a circle. The intense itching causes the animal to scratch and rub its ears as well as shake its head.

Control of ear mange.--Since ear mites live on the surface of the skin, this type of mange is the most easily controlled. The dog should be held so that the ear canals may be treated without damaging the eardrum. After cleaning out the ear, the canal should be swabbed with any one of the following insecticides: 1 percent phenol (carbolic acid) in glycerin; 5 percent phenol in castor oil or olive oil; or a mixture of 1 part carbon tetrachloride and 3 parts castor oil. Treatment should be given daily until all traces of infestation have disappeared.

Demodectic Mites

The most common of the parasitic skin diseases of dogs is red mange. A wormlike mite (Demodex canis Leydig) is the cause of this type of mange. This mite lives in the hair follicles and sebaceous glands, but the facts concerning its life history are not well-known. Females deposit eggs which, on hatching, are similar to adults. Larvae molt as do other mites, but the time required to complete the life cycle is unknown. The disease is usually found in young dogs, particularly short-haired dogs, but it may attack animals of any age.

Symptoms of demodectic or red mange---

The first symptom of this disease is the appearance of red spots on the skin where the hair has fallen out. This is usually around the eyes, elbows, hocks, toes and other places on the body. Some itching may be present as the disease advances, but it is not as intense as in sarcoptic mange. Later when more hair drops off, the skin presents a copper color from which the name "red mange" originated. The skin may develop a gray or bluish color in cases of heavy infestations. The hairless type of the disease is complicated through lowered resistance and by the presence of pus-forming bacteria. Poisons formed in the pustules by the bacteria are liberated in the animal's system and as a result body functions are impaired. Emaciation, weakness, and an unpleasant odor develop, and unless treatment is given, the animal dies.

Control of demodectic mange. Dogs should be clipped, bathed, and all crusts and scabs removed before control measures are applied. After bathing, repeat this process until animal is cured. Treatment of this disease is very difficult, but the most promising insecticide appears to be a 1 percent solution of rotenone in alcohol or oil. Dissolve the rotenone in a small amount of acetone and add the proper proportions of alcohol or a bland oil, depending on the type of solution desired. An oil solution is usually preferred since it tends to keep the skin soft and pliable. Apply the insecticide daily with moderately rough massage to affected parts or entire body, depending on extent of lesions. Continue treatment daily for two weeks to effect a cure. The derris wash suggested for sarcoptic mange has been responsible for a number of cures. Apply this

wash every other day for two weeks, then once a week for 4 weeks.

LICE

Of the two species of lice found on dogs, one is a sucking louse, Linognathus piliferus (Burm.), and the other a biting louse, Trichodectes canis Deg. The sucking louse is less than one twelfth of an inch long, is pale yellow, and has a long slender head, while the biting species is a clear yellow, is smaller, and has a wide blunt head. Sucking lice feed on the serum and the blood, while biting lice live on scales, scurf, and superficial portions of the skin. T. canis is an intermediate host of the tapeworm.

Symptoms

Intense itching causes animals to scratch and rub themselves against objects. This action may create sores and constitute a drain on their nervous energy. Pups, old dogs, and long-haired dogs are much more susceptible to infestation than dogs of mature age and short-haired varieties.

Control

Several measures have been found effective for controlling lice on dogs:

1. Coal tar creosote dips may be used 2 or 3 times at intervals of 8 to 10 days. This insecticide should be diluted according to directions on the container.

2. A pyrethrum dust may be applied to animals. In order to destroy all lice on an animal, treatment should be repeated a number of times.

3. Derris may be used as a dust in the proportion of 1 part derris to 2 parts flour, cornstarch, or talcum. The mixture should be dusted into the hair.

A PEST OF PIGEONS: THE PIGEON FLY

A pest of carrier pigeons, the pigeon fly (*Pseudolynchia canariensis* Macq.) (fig. 5) is not much smaller than the housefly, is flat, brownish, and crawls rapidly among the feathers to suck blood of both squabs and adults. The fly transmits an organism which causes pigeon malaria, a disease the exact effect of which on birds has not yet been determined.



Fig. 5.--The pigeon fly.

Life History and Habits

Often pigeon flies will bite man when pigeons are being handled and irritation may continue for several days. No marked

evidence of their bites is apparent on pigeons, however, but the birds seem to be greatly annoyed by them. Both irritation and loss of blood prove injurious to squabs as well as adults. In warmer parts of the country the flies are active on pigeons through the winter, but in the spring, the number of flies diminishes. Female flies deposit mature larvae in pale yellow pupal cases (fig. 6) singly

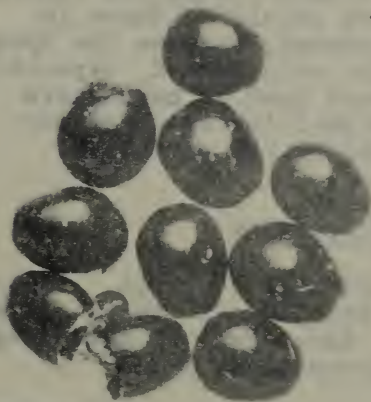


Fig. 6.--Group of
pigeon fly pupae.

among the feathers of the pigeon. These, in about three hours, become shiny black. Although they may hang for a short time in the feathers, they soon drop into the nest and usually fall to the bottom of the nest boxes. Adults emerge about 25 days later when the temperature is high, but in about 31 days or longer when the weather is cold.

Control

Cleaning of
nests.--Nests should
be cleaned thoroughly

every 25 days and the trash burned. Pupae may be brushed out of the cracks of nests, and since a number of pupae roll to the bottom of the nest boxes, it is easy to pick up the nest and clean it from the top downward. Falling pupae should be collected on paper and burned.

Pyrethrum, derris, and cube.--One to 3 pinches of fresh pyrethrum powder may be applied to squabs for killing adult flies. The amount varies with the size of the bird. Derris or cube powder (containing 3 to 5 percent rotenone) is almost as effective as pyrethrum and should be used in the same way.

Fly sprays.--Pupae may be killed by thoroughly wetting them with one of the standard fly sprays. This may also be used in a light spray on the pigeons themselves as the feathers are lifted. Great care should be taken in spraying the birds, however, because the eyes may be made sore or the skin burned, especially that of squabs. Pigeons used as messengers should be kept free of the flies as their performance is handicapped by the parasites.

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